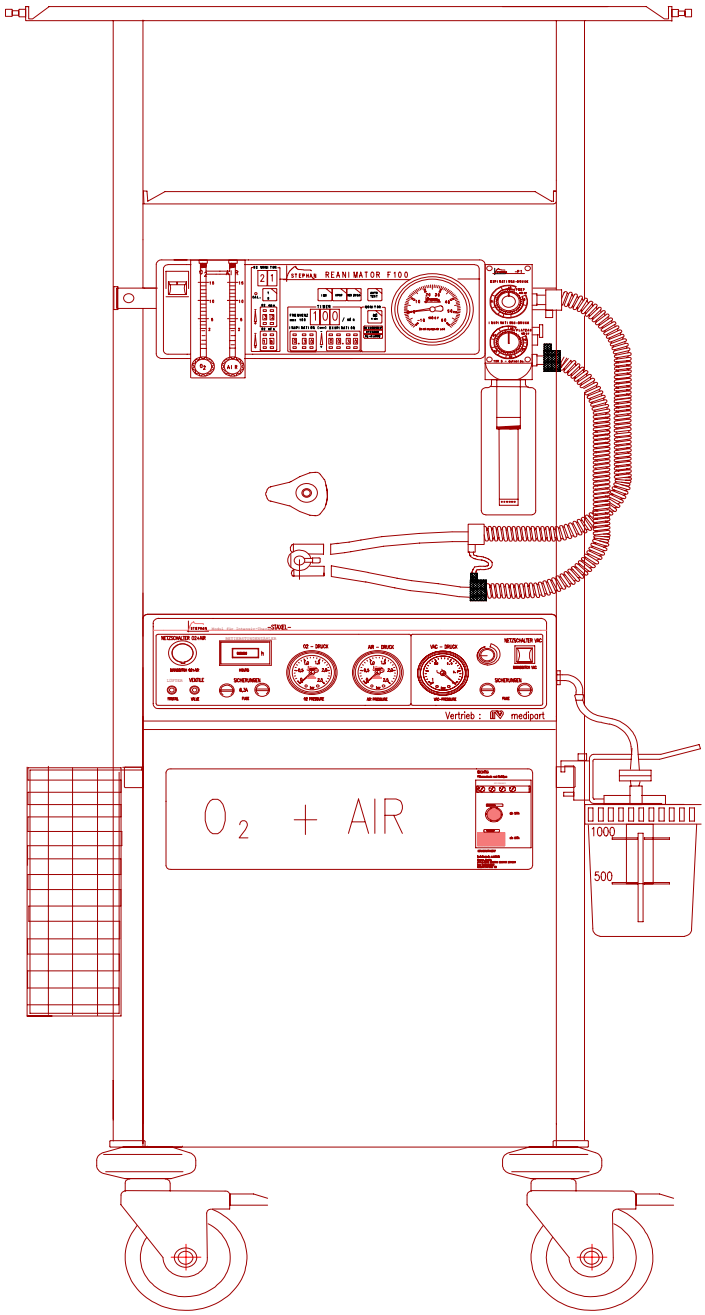
STEPHAN
O2-AIR-ENERGY SUPPLY MODULE

STAXEL 1,5 3,5



SERVICE MANUAL

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1. General notice

The STEPHAN – S T A X E L - unit serves for the production of oxygen and compressed air as well as for the production of vacuum and is primarily designed for the operation of appliances for pediatrics and anaesthesia.

It continuously produces oxygen from the ambient atmosphere and thus offers an economocal alternative to the supply of oxygen from cylinders or the supply with liquid oxygen.

The **STAXEL –** basic unit is available for diverse applications:

STEPHAN STAXEL „PEDIATRICS“ (for 2 respirators)

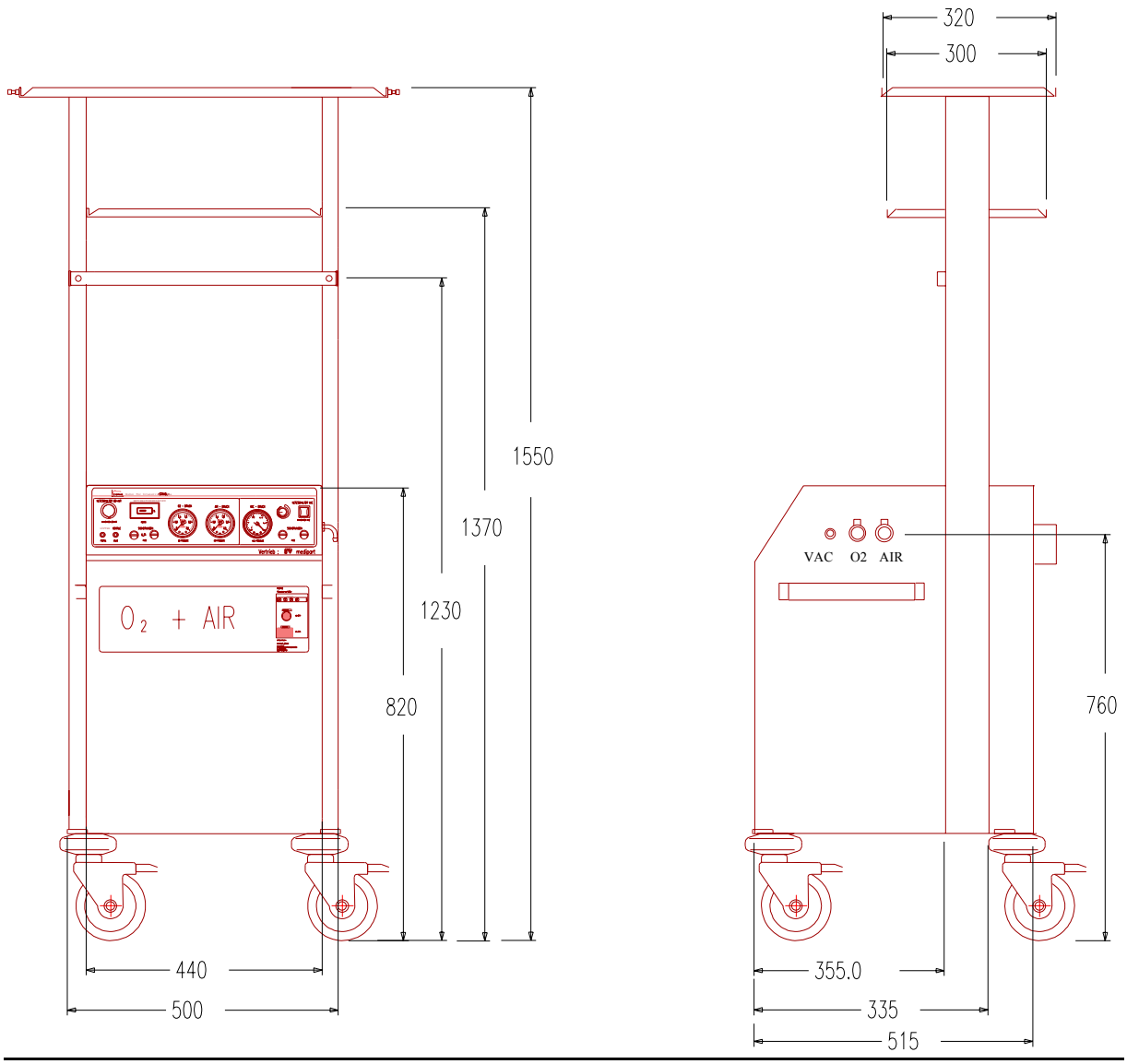
STEPHAN STAXEL „ANAESTHESIA“ WITH RESPIRATOR

Note: Upon request or order also other combinations are available

The STAXEL can be mounted on a service carriage and thus offers the greatest possible mobility and flexibility.
It is made from stainless steel and therefore extremely resistant against weathering and easy to keep in hygienic condition.

The STAXEL is available with a number of different shelves, brackets for appliances and appliances rails for attaching instruments, holding devices or vessels.
Furthermore, four earthed sockets (Schuko) (230 V) are provided on the rear panel, where diverse other appliances can be connected.

2. Technical dimensions



3. Construction and description of performance

3.1 Production of oxygen

The production of oxygen is based upon the adsorption effect of molecular sieves. For this purpose, air which has been compressed by compressors is blown through two containers, which are filled with molecular sieves.

Since the molecules of oxygen are smaller than these of nitrogen, the oxygen can pass the sieve unimpeded, whereas the nitrogen is aborbed completely by the molecular sieve. Thus, air enriched with oxygen is obtained at the outlet of the container.

Concentration of oxygen is approximately 95 % (with an extraction of 5 litres / min). The remaining 5 % are inert gases contained in the normal ambient atmosphere like argon, neon, xenon etc.

Of the two containers filled with molecular sieves, only one at a time takes part in the production of oxygen.

Prior to the first container being completely saturated with nitrogen, changeover to the second container, which now performs the enrichment of air with oxygen, takes place.

While the second container is in operation, the first one is cleaned, using a portion of the produced oxygen and can continue with the enrichment with oxygen, when the second container is saturated with nitrogen. This process is cyclic and continuous.

3.2 Production of compressed air

Compressed air is produced by means of the two compressors, which also compress the ambient air required for the production of oxygen. The compressed air is collected in a compressed air reservoir and is now available for the production of oxygen as well as for use as medicinal compressed air. The ambient air is hereby conducted through an intake filter and a bacteria filter and then compressed in the compressors, which both operate free of oil. Thus the production of compressed air always runs in parallel with the production of oxygen. The moment the STAXEL is switched on , it produces compressed air as well as oxygen.

3.3 Generation of vacuum

Vacuum is generated by means of a vacuum pump, which is additionally installed in the STAXEL.
In parallel to the production of O2 and AIR, this vacuum pump can be switched on and off separately. Vacuum pressure is infinitely adjustable from – 0,1 to – 0,6 bar by means of a rotary knob.

3.4 Construction

The entire supply module is mounted in a sound-insulated twofold-steel housing, all rotating components, like compressor or fans are mounted oscillation-attenuated. The escaping exhaust air is evacuated via a noise-reducing filter.

The front panel of the appliance contains the displays of operating pressure for O2, AIR and VAC as well as a hours-run-meter to indicate the scheduled intervals for maintenance and servicing (exchange of filters etc).

The entire module is mounted onto a sturdy undercarriage with an appropriate holding rail, so that all STEPHAN respirators as well as reanimators (pediatrics respirator F 150 and HF 300 SIMV) can be used. The respirators can easily be detached from the unit and attached to a wall rail system or to the incubator.

Attention:
The unit must **not be operated without micro filter !!**

4. Installation and startup

4.1 Environmental conditions

The STEPHAN S T A X E L is intended for installation in dry rooms without risk of splash water or water drops. Humid or wet environment can seriously impair the reliability of the unit. Special care has to be taken to avoid placing containers filled with water or similar objects in the near vicinity.

The ambient temperature should in no case exceed+ 40° C.

With a prevailing relative air humidity it is recommended to operate the unit only in air-conditioned rooms.

The air – intake grids at the rear of the unit must not be covered or obstructed with any objects.

Distance from the rear of the unit to the wall should be at least 10 cm.

The STAXEL must not be operated in rooms, where an explosion hazard exists !!

The STAXEL must not be operated in the vicinity of open fire or red hot objects because of the increased explosion hazard, which exists on account of the ambient air being enriched with oxygen of high purity.

4.2 Startup

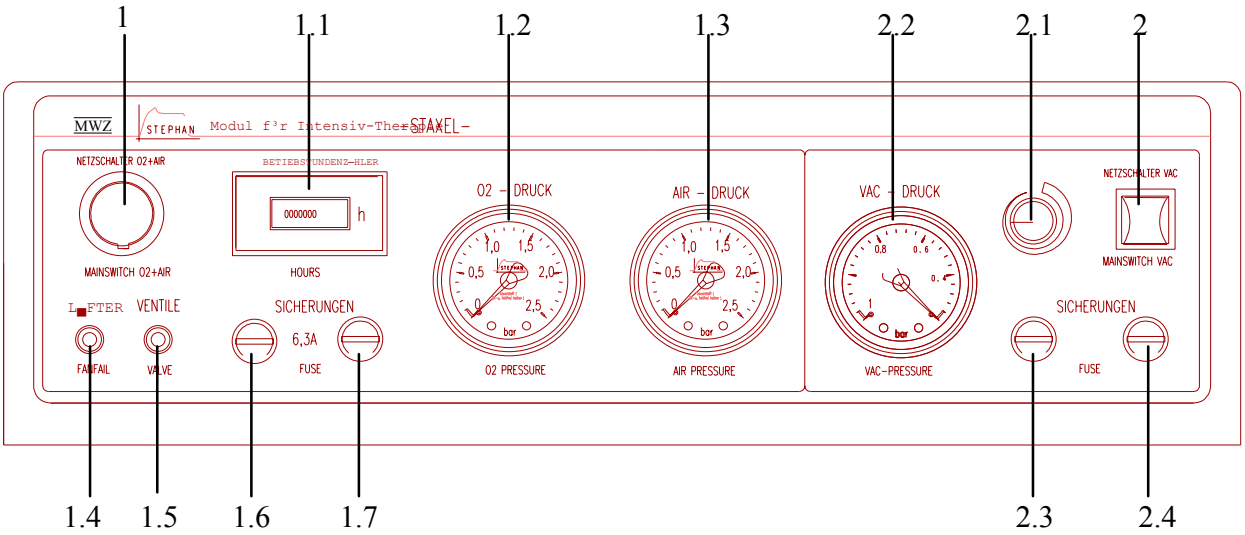
First the STAXEL is connected to the mains supply (socket).
The STAXEL has two mains switches, one mains switch for the production of O2 and AIR and a second one for the generation of vacuum.

By means of the mains switch ′O2 and AIR′ the unit is switched ON and OFF for the production of oxygen and compressed air.
Immediately after switching it on, the „STAXEL“ starts to produce oxygen and compressed air.
The respective pressure gauges on the front panel, blue for oxygen and yellow for compressed air, indicate the pressure at the respective outlets.
The typical values for oxygen and compressed air are 1 bar.

By means of the mains switch ′VAC′ the unit is switched ON and OFF for the generation of vacuum.
Immediately after switching it on, the „Staxel“ starts to generate vacuum.
The pressure gauge at the front panel, white for vacuum, indicates the pressure at the respective outlet.
The typical value for vacuum is – 0,5 bar.

On both sides of the unit one connection each for oxygen and compressed air is provided.
An additional connection for vacuum is provided on the right side of the unit.
During normal operation always one pair of connections (O2 and AIR) is used. If necessary, the „spare pair of connections“ can be used in parallel for connecting a second respirator or incubator.

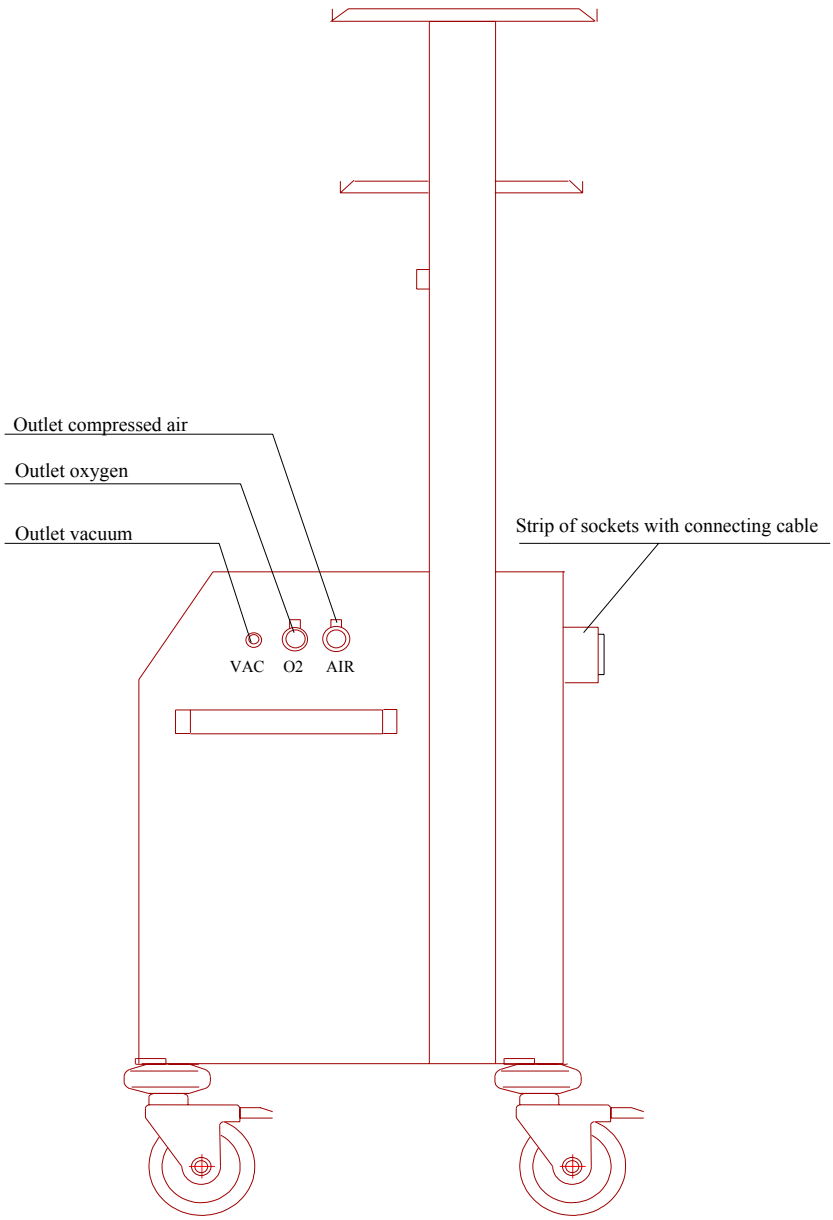
5. Control – and display elements



1	Mains switch ON / OFF for O2 and AIR
1.1	Hours – run – meter for the production of O2 and AIR
1.2	Pressure gauge for indication of O2 – pressure
1.3	Pressure gauge for indication of AIR – pressure
1.4	Visual alarm for over – heating
1.5	Visual alarm for failure of electronics or switching valves
1.6	Fuse for O2 - and AIR – production
1.7	Fuse for O2 – and AIR – production

2	Mains switch ON / OFF for VAC
2.1	Rotary knob for regulating the vacuum pressure
2.2	Pressure gauge for indication of vacuum pressure
2.3	Fuse for generation of VAC
2.4	Fuse for generation of VAC

6. Connections for oxygen, compressed air and vacuum



Outlets for O2 and AIR are located on both sides of the STAXEL. The connections are quick-coupling and are are interlocked automatically after plugging in. To unplug them, the unlocking pin on the top of the connection must be depressed.

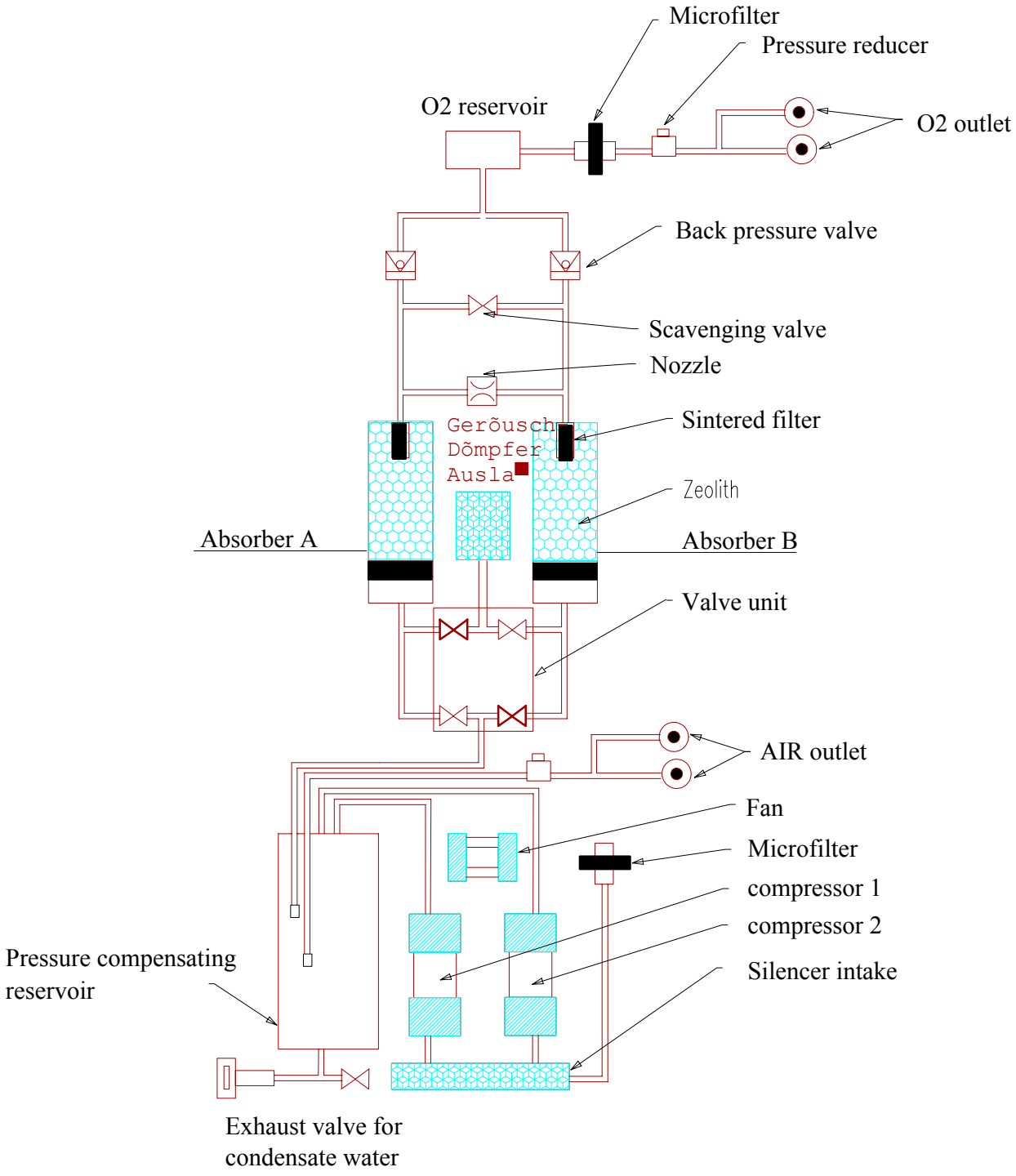
The outlet for vacuum is located at the right side. The connection consists of a 1/8“ female hose connector. The hose leading to the suction unit is slipped on.

7. Technical description

7.1 Description of system

Ambient air is taken in via a microfilter, led through a silencer inlet and finally compressed in the compressors 1 + 2. The compressed air is then conducted over a condenser and cooled, before it is collected in a pressure compensation reservoir. This reservoir is provided with an exhaust valve for condensate water, which briefly opens every 45 minutes and blows the condensate water out.
The compressed air reservoir is continuously filled with compressed air from the compressors. The AIR - outlets are supplied with compressed air from this reservoir. The output pressure is limited to 1 bar by means of a pressure reducing valve. The compressors operate free of oil, thus the provided air is medicinal compressed air.
The compressed air from the pressure compensation reservoir also supplies the two adsorber containers A + B via a valve unit. The valve unit consists of a 5 / 2 – way valve, which is electronically controlled. The valve is constructed in such a way, that only one adsorber at a time takes part in the production of oxygen, while the other one is being scavenged and cleaned.
The compressed air is conducted through the adsorber containers.
The adsorber containers are filled with a special granulate, which works like a molecular sieve. On account of the different sizes of molecules, the nitrogen contained in the air is physically adsorbed, while oxygen and portions of inert gases are not adsorbed and form the residual gas atmosphere, which is led into an O2 – resrevoir.
Through a nozzle and a scavenging valve, which are located at the outlet of the adsorber containers, the adsorber not participating in the production of oxygen at this moment is blown through with a portion of the produced oxygen and the nitrogen is flushed into the atmosphere. This procedure is periodically repeated, whereby two adsorber containers are used alternatingly to increase efficiency. The two adsorber containers are interlocked against one another via two back pressure valves so that in the course of changing over to the adsorber container, which participates in the production of oxygen the produced oxygen is not completely blown through the adsorber container that has to be cleaned, but flows into the O2 – resrevoir.
The O2-outlets are supplied with oxygen from the reservoir via an additional microfilter. Pressure at the outlet is limited to 1 bar by means of a pressure reducer.

7.2 Schematic representation



7.3 Switching attitude of the valve unit

Switching position A:

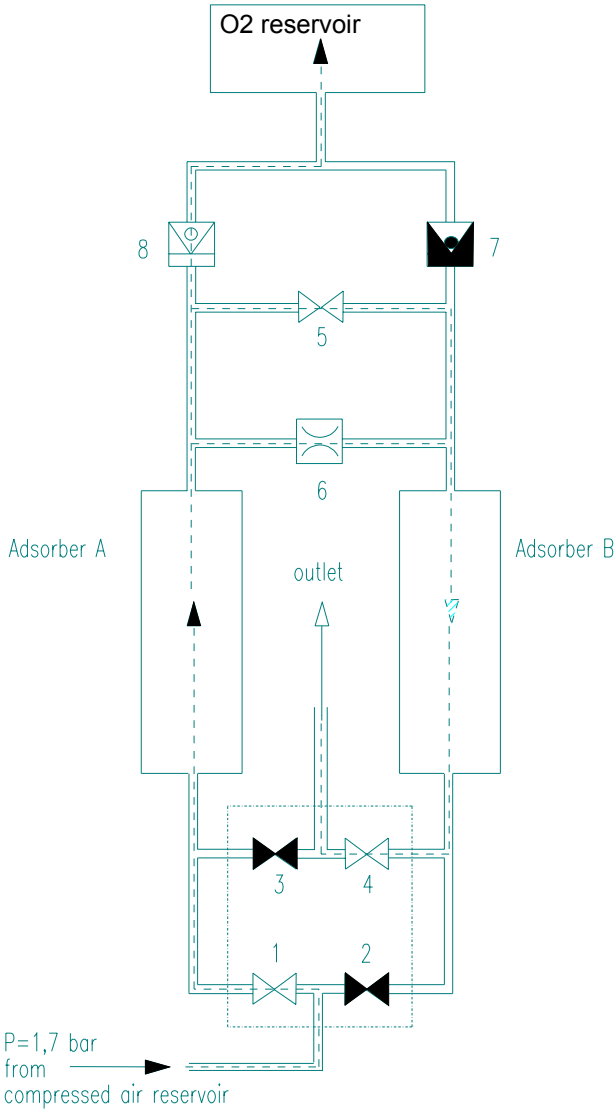
Medicinal compressed air of 1,7 bar from the pressure compensation reservoir is available at the valve unit.
In switching position A the valves 1 + 4 are open. Through valve 1 flows compressed air through the adsorber container A. The molecular sieve adsorbs the nitrogen part of the compressed air. The residual gas atmosphere, consisting of oxgen and portions of inert gases is conducted into the O2-reservoir via the back pressure valve 8.
A small part of the produced oxygen is conducted through a nozzle 6 to the adsorber B. The oxygen, whose speed of flow is accelerated by the nozzle, now flows through the adsorber B, scavenges the adsorbed nitrogen and flows to the outlet via the open valve 4.
One second ahead of the changeover from adsorber A to adsorber B, the savenging valve 5 opens for the duration of two seconds and provides for the adsorber B to be scavenged once again with a large portion of oxygen. After a cycle of 13 seconds the changeover from adsorber A to adsorber B takes place.

Switching position B

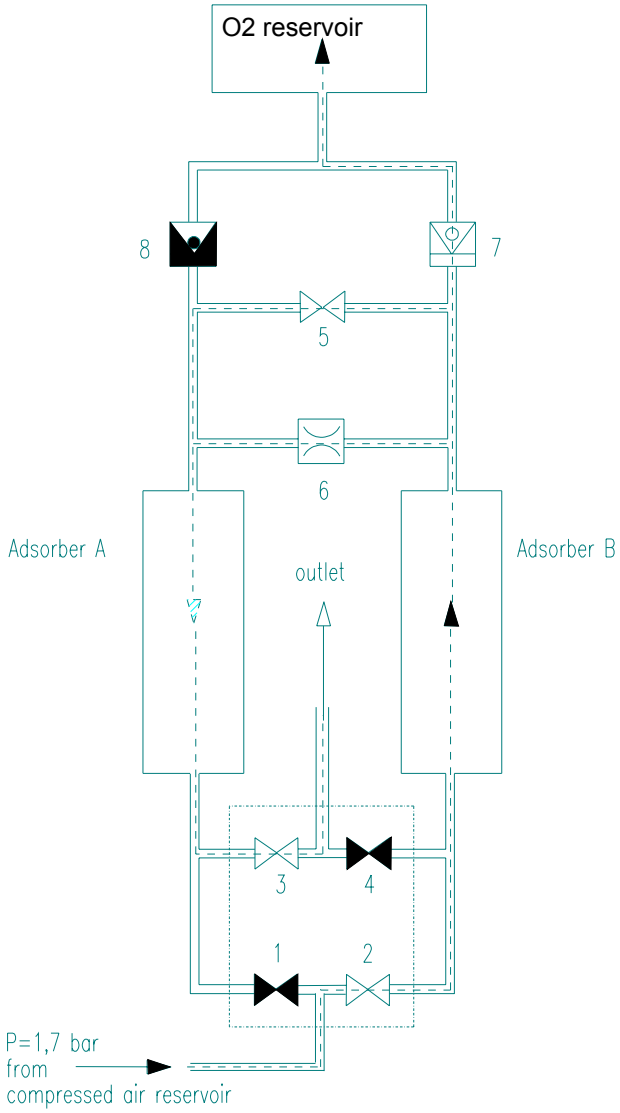
Medicinal compressed air of 1,7 bar from the pressure compensation reservoir is available at the valve unit
In switching position B the valves 2 + 3 are open. Through valve 2 flows compressed air through the adsorber container B. The molecular sieve adsorbs the nitrogen part of the compressed air. The residual gas atmosphere, consisting of oxygen and portions of inert gases is conducted into the O2-reservoir via the back pressure valve 7.
A small part of the produced oxygen is conducted through a nozzle 6 to the adsorber A. The oxygen, whose speed of flow is accelerated by the nozzle, now flows through the adsorber A , scavenges the adsorbed nitrogen and flows to the outlet via the open valve 3.
One second ahead of the changeover from adsorber B to adsorber A the scavenging valve 5 opens for the duration of two seconds and provides for adsorber A to be scavenged once again with a large portion of oxygen. After a cycle of 13 seconds the changeover from adsorber B to adsorber A takes place.

The changeover between adsorber A and B takes place cyclic and continuously.
All the switching times are a fixed program in the control electronics of the STAXEL and can not be altered. Switching cycles can be checked by means of the LEDs on the control board.

Valve control O2 – separation:



Switching position A



Switching position B

8. Technical details

Available concentrations of oxygen with respective flow

Flow (l / min)	O2 – concentration (in %)
1	95
2	95
3	95
4	95
5	94
6	91

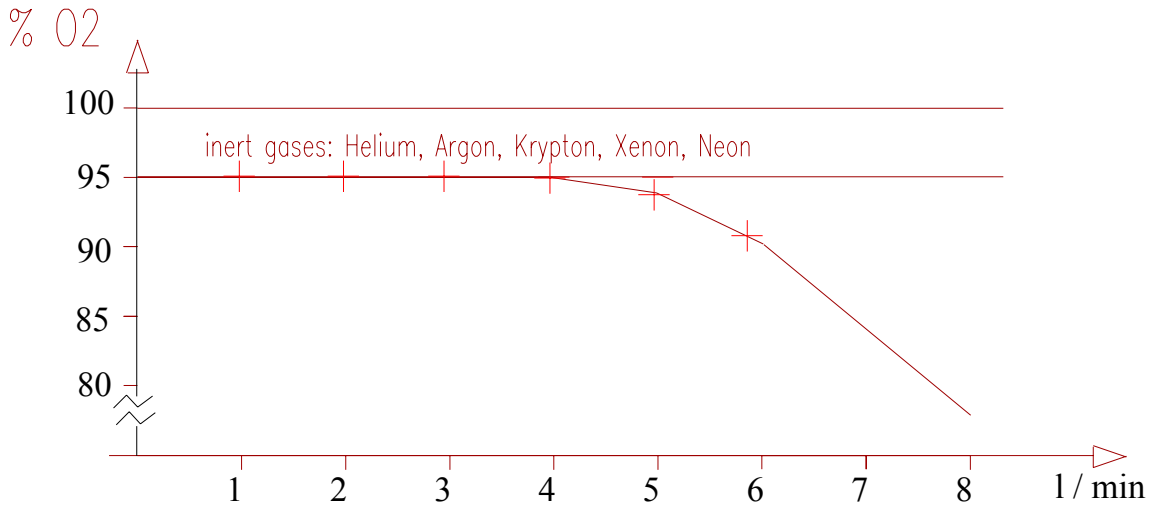
The values apply with a temperature of 25° C and a relative air humidity of 60 %.

Furthermore, concentration of O2 fluctuates for + / - 2 %

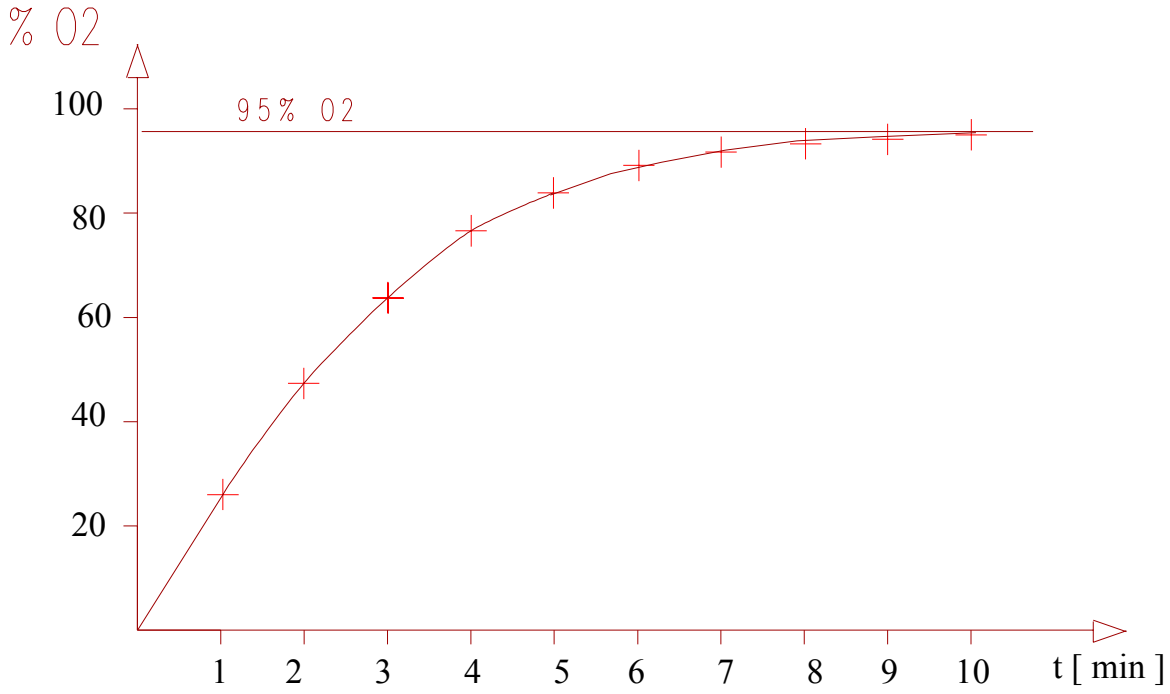
Specifications

Supply voltage	230V / 50Hz
Current consumption	5 A
Changeover cycle	13 sec
Duration of one scavenging	2 sec
Noise level	48 dB (A)
Dimensions (L x W x H)	500 x 510 1550
Weight	ca. 65 kg
Compressor	
Number of revolutions	1380 R/min
Power consumption	2 x 250 watt
Capacitor	2 x 8 µF / 400 V
Fan::	
Number of revolutions:	930 R/min
Power consumption	1 x 80 watt
Capacitor	2 µF / 400 V

9. Performance data of STAXEL



Production of oxygen dependent on consumed quantity



Produktion of oxygen dependent on time, with consumption of ca 6 litres/min

10. Error detection system

Error	Cause	Elimination
No pressure at O2 and compressed air, audible alarm	Failure of supply voltage fuse defective	Check supply voltage Exchange fuse
Initial pressure of O2 or compressed air falls below 0,7 bar audible alarm	Microfilter is obstructed Consumption of gas is too high Compressor defective Leak in line	Exchange microfilter Reduce consumption of gas notify service agency
Red LED (1.4) illuminates , Staxel is overheated unit ceases to operate	Airflow is too weak	Exchange filter mat check fan for sufficient performance (exchange if necessary
Red LED (1.5) illuminates	valves do not switch properly Electronics defective Compressors defective Supply hose torn off	Notify service agency
Concentration of O2 falls below minimum value	Pressure between the two adsorber containers is no longer balanced, obsolete adsorber containers	Adsorbers must be adjusted anew adsorber containers must be exchanged

11. Maintenance

Maintenance

The Stephan STAXEL requires only little maintenance.

For hygienic reasons the unit should be cleaned periodically by wiping it, using customary household cleansing agents or disinfectants (e.g Sagrotan, diluted).

The microfilter and the filter mat must be exchanged every 10 days or after each 240 hours run.

12. Guarantee

If used according to instructions, the product is guaranteed for 12 months from the date of sale.
The guarantee applies to replacement and repair of parts, for which a fault in material and manufacturing can be acknowledged.

13. Service

To warrant faultless performance, the units must be checked after each approximate 1000 hours run, at least, however, once a year, by an authorized specialist firm. Eventually occurring disorders or failures must only be eliminated by the service department. After 10.000 hours run, a general overhaul has to be carried out by the service department.

13.1 Power supply

The mains supply takes place by means of a connection cable, which is led into the strip of sockets on the rear of the STAXEL. The terminal block (230 V) is connected with the strip of sockets by means of an interconnecting cable. The mains supply L 1, N and PE is led from the terminal strip to the mains switch ′O2 + AIR′ in the STAXEL – housing lid. (Designation of terminals: 1,2,3). The mains switch switches the mains supply bipolar on, resp.off. From the mains switch ′O2 + AIR′ the switched mains supply is led back to the terminal block (Designation of terminals: 7,9,). The terminal block (230 V) supplies the two compressors 1 + 2 , the fan, as well as the control board with the switched mains supply.

On the control board the 230 V mains supply is transformed and converted to 5 V (DC) and 24 V (DC).

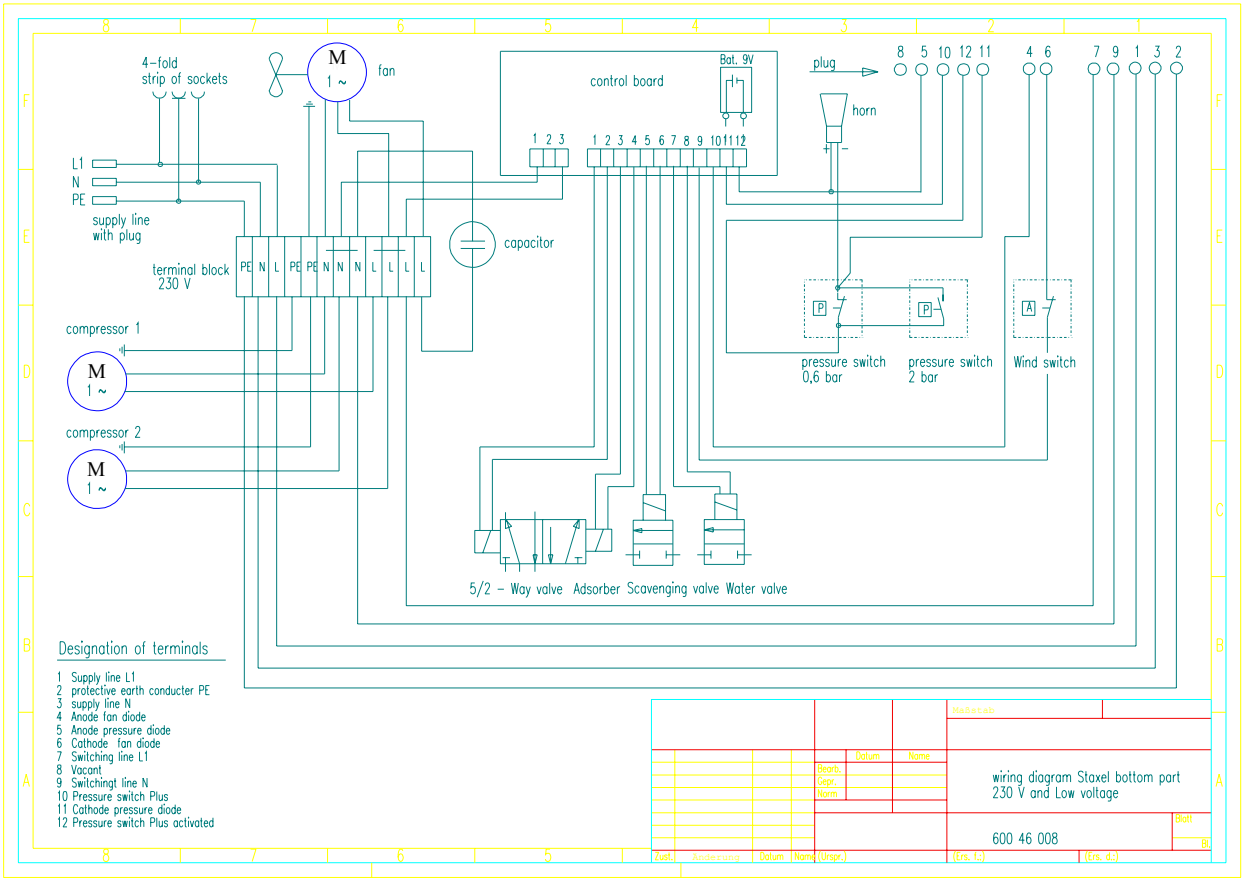
The valves are activated with 24 V (DC). The pressure switches and the wind switch are supplied with 5 V (DC). A 9 V – battery is connected in parallel to the 5 V – supply. This battery takes over the voltage supply of the monitoring components (pressure switch and horn) in case of failure of mains supply.

The 5 V – supply is switched on and off by means of the mains switch O2 + AIR, (designation of terminals10, 12) and then supplies the pressure switch. In case of failure, the pressure – LED in the lid of the STAXEL is activated (designation of terminals 11, 5). In addition, the horn sounds.

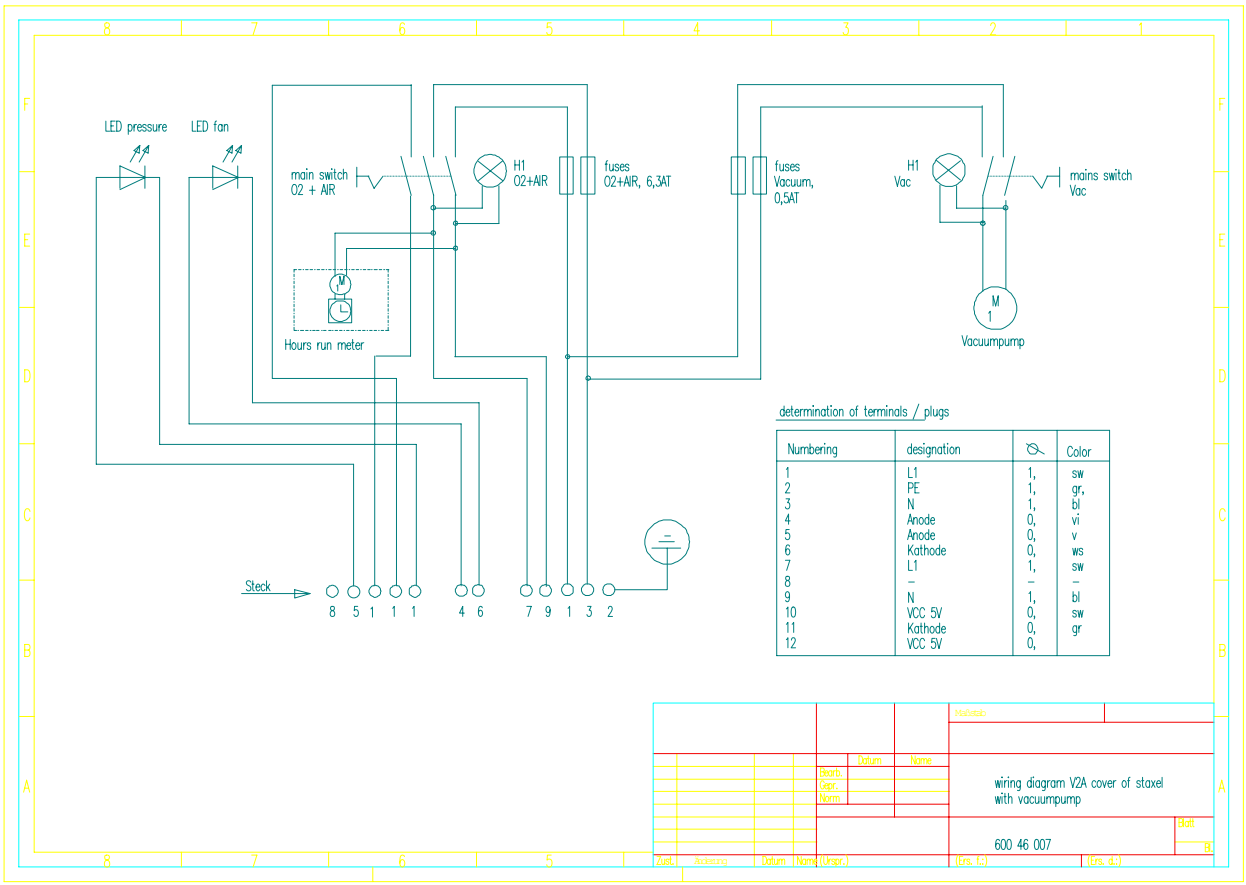
The wind switch is supplied with a second 5 V – voltage, which is tapped directly from the control board. In case of failure, the fan LED in the Staxel – lid is activated. (designation of terminal 4, 6).

Voltage supply (230 V) for the vacuum pump is tapped in parallel from the terminals 1 + 3 in the STAXEL – lid. The vacuum pump is switched on, respectively off, directly by means of the mains switch ′VAC′.

13.2 Wiring diagram, STAXEL bottom part



13.3 Wiring diagram V2A – cover of STAXEL



Numbering	designation		Color
1	L1	1,	sw
2	PE	1,	gr,
3	N	1,	bl
4	Anode	0,	vi
5	Anode	0,	v
6	Kathode	0,	ws
7	L1	1,	sw
8	–	–	–
9	N	1,	bl
10	VCC 5V	0,	sw
11	Kathode	0,	gr
12	VCC 5V	0,	

13.4 Adjustment of the adsorber containers

To guarantee a faultless performance of the STAXEL, a check and in case a renewed calibration of the pressure controllers on the O2-reservoir should be carried out with each servicing. In addition, the adsorber containers must be checked.

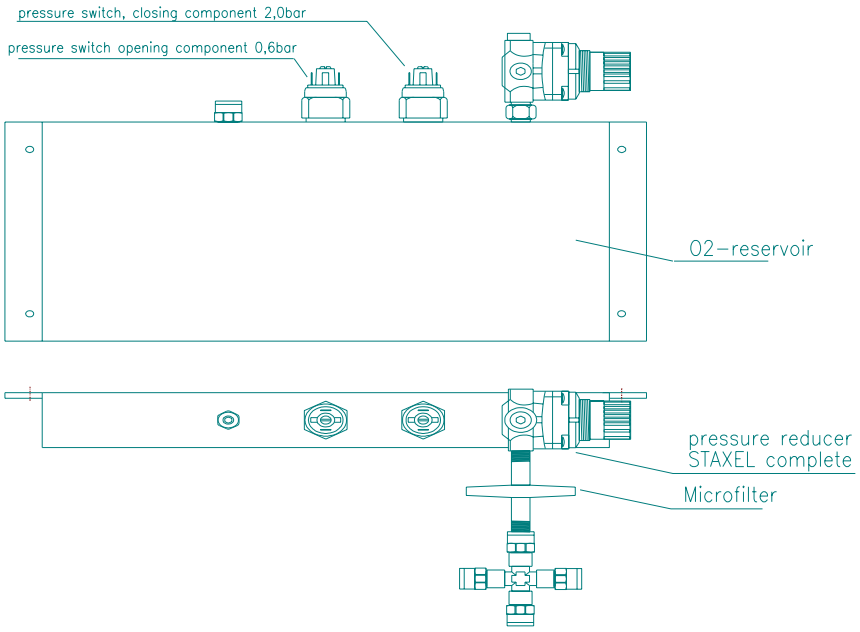
Checks:

- all tubes and copper tubes must be checked for leaks
- coarse filters and microfilters must be exchanged if necessary
- faultless performance of the solenoid valves must be checked
- the filter mat at the intake grid of the blower must be exchanged if necessary.

Pressure controller of O2 reservoir

The two pressure controllers for minimum and maximum pressure on the O2-reservoir must release an alarm with the following values:

limit for minimum pressure:	0,6 bar
limit for maximum pressure	2 bar



Adsorber container

To guarantee maximum concentration of O2, calibration must be carried out as follows:

- pressure gauges must be installed as shown in figure 1
- hereafter, the STAXEL must run for 10 minutes under operating conditions
- a flow of 6 l/min is set on tbe O2-connection, a flow of 5 l/min is set on the compressed-air-connection
- pressure displayed by the pressure gauges should be 0,1 bar on the exhausted adsorber and must rise to approximately 1,5 bar, when the adsorber is filled again.

Attention: If pressure with exhausted adsorber does not fall below 0,2 bar, the outlet filter must be exchanged (see 13.5.6) !

- deflections of the pressure gauges on both adsorber containers must take place simultaneously and in contrary direction.
- concentration of O2 should now have a value of not below 90 %

Supplement for the adjustment of the adsorber containers

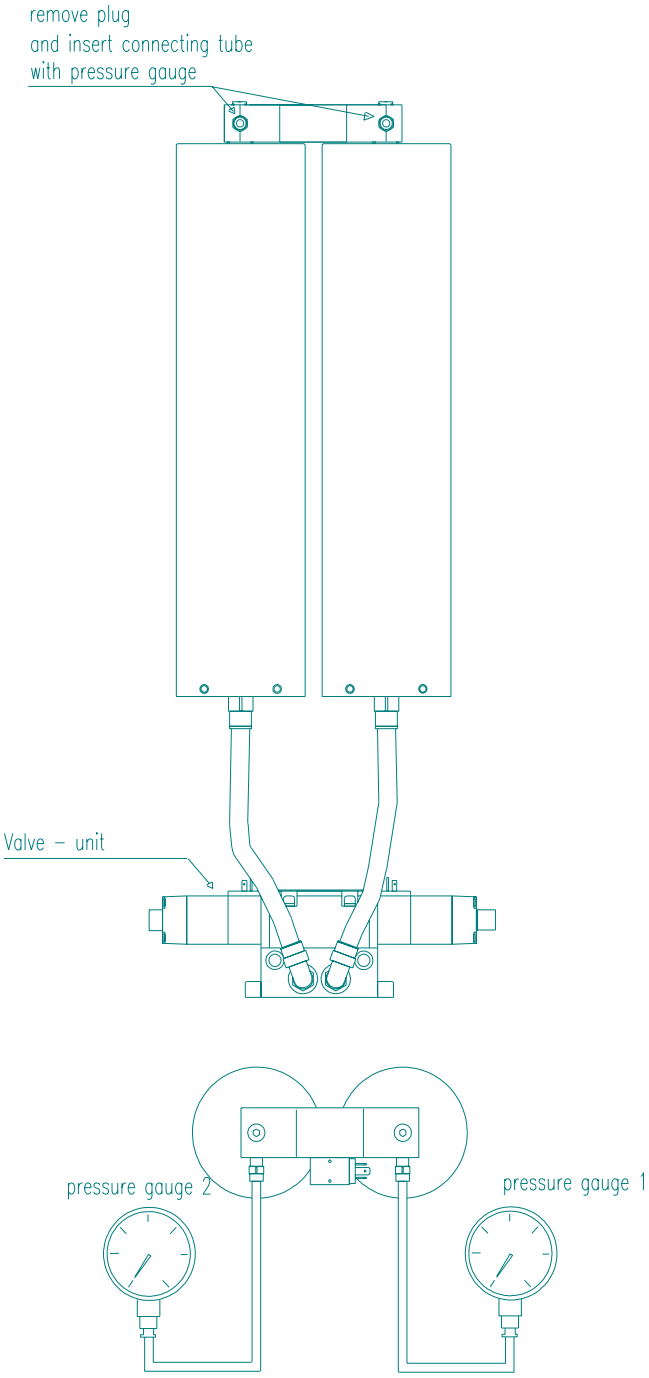


Figure 1

13.5 Technical details

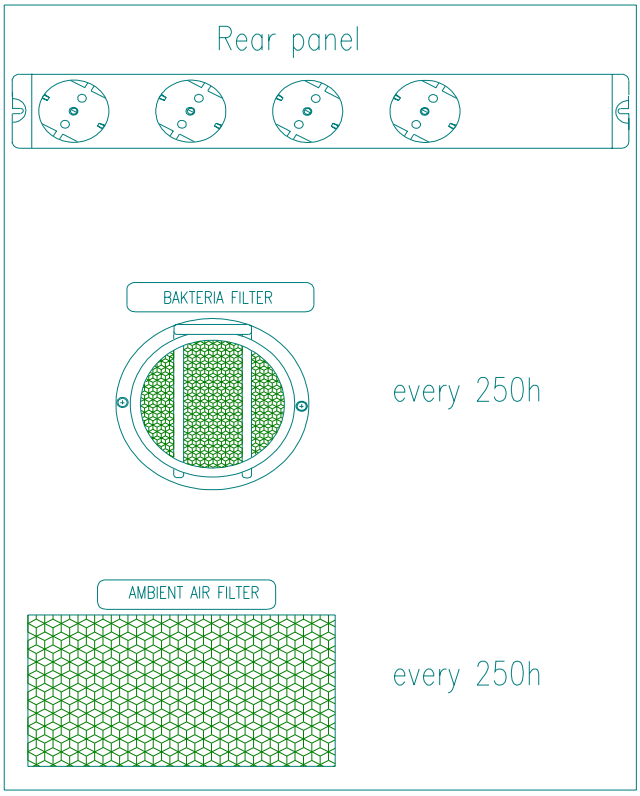
13.5.1 Exchanging the bacteria filter and the intake filter mat (ambient air filter)

Bacteria filter

The bacteria filter is located at the rear of the STAXEL. The retaining clip is pulled upward and out, the old filter set is removed and the new set is inserted. Hereafter the retainig clip is replaced.

Intake filter mat

The intake filter mat (ambient air filter) is located at the rear of the STAXEL. The old filter mat is pulled out of the fixture and the new filter mat is inserted.



13.5.2. Removing the top part, the rear panel and the side covers

Top part

-unscrew the holding screws
-lift the top part
-disconnect the electrical connections on the plug
-pull off tubes from the pressure gauges

Rear panel

-unscrew the holding screw
-detach rear panel until the intake tube slides out of its mounting
-disconnect the electrical connection at the terminal block

Side cover

-remove top part and rear panel
-unscrew and remove the square tubes of the assembly elements
-unscrew the remaining screws at the lower rim
-detach side covers so far, that the connections with the outlets for O2 and AIR can be disconnected
-pull the complete side cover forward and out and remove it.

13.5.3 Removing the adsorber containers

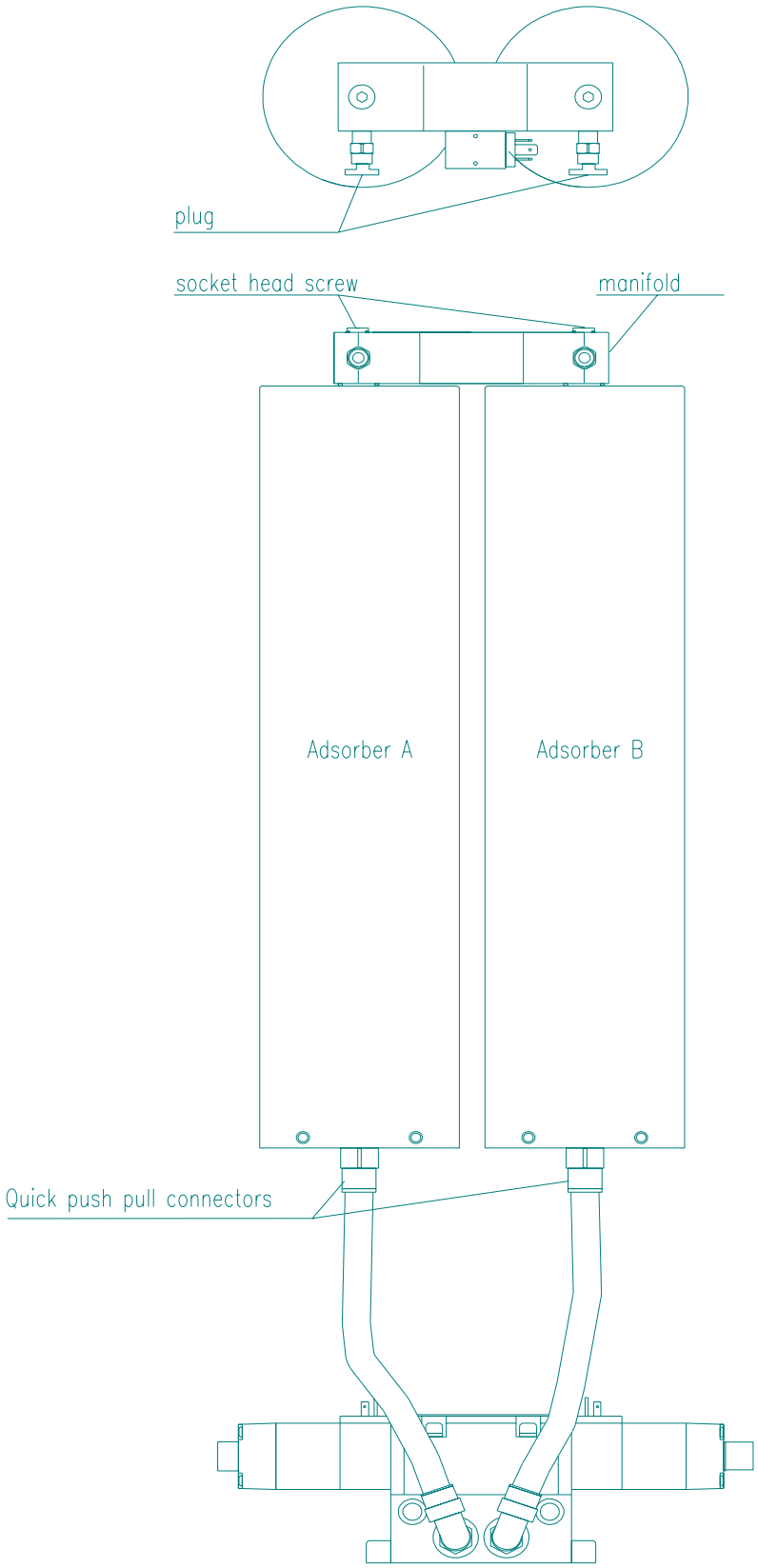
-remove top part and rear panel
-unscrew the two socket head screws on the adsorber manifold and remove the -manifold
-undo the two holding straps on the adsorber containers
-last disconnect the quick push-pull connectors at the bottom of the adsorber containers
-remove the adsorber containers

Important: Always close the removed adsorber containers airtight, because otherwise the granulate (molecular sieve) will be destroyed.

ATTENTION !!

Do not attempt to disassemble the adsorber containers. The filling material of the adsorbers is compressed by means of a spring with a spring rate of 450 N !
Adsorber containers must always be exchanged completely.

Adsorber container



13.5.4. Removing the compressed-air-reservoir

- remove STAXEL top part and rear panel
- unscrew brass screw coupling on the copper tube
- pull PVC tubes on top out of the quick push-pull connector
- undo holding straps
- pull exhaust valve for condensate water and excess pressure valve on the bottom out of the quick push-pull connectors
- remove air reservoir

13.5.5. Removing the compressors

-remove top part, rear panel and side covers
-unscrew the screws of the front panel on the compressor housing, remove front panel
-unscrew the screws of the cover on compressor housing
-disconnect the copper tube from compressed air reservoir
-undo and remove hose clamp of fabric tube on the cooler
-remove socket strip from the control board
-disconnect all electrical connections on the terminal block (note allocation of terminals)
-lift off cover of compressor housing complete with fan
-loosen fabric tubes on the compressors and remove them.
-unscrew mounting rails of compressor (4 X nut M5)
-take compressors out

13.5.6. Exchanging the outlet filter

-remove top part, rear panel and side covers
-unscrew screws of the cover on compressor housing
-disconnect the copper tube from compressed air reservoir
-undo and remove hose clamp of fabric tube on the cooler
-remove socket strip from the control board
-disconnect all electrical connections on the terminal block (note allocation of terminals)
-lift off cover of compressor housing complete with fan
-unscrew and remove the old outlet filter from rear panel of compressor housing
-screw in new outlet filter

14. STAXEL set of spare parts for an operating period of 2 years

Item	Product number	Designation	No. of pieces
1	804 60 008	Fuses 6,3 A (slow-blow)	2
2	804 60 003	Fuses o,5 A (slow-blow	2
3	600 61 115	Bacteria filter set	15
4	600 61 123	Intake filter mat	10
5	811 60 010	Batteries S1	3
6	600 40 046	Sound absorber	3

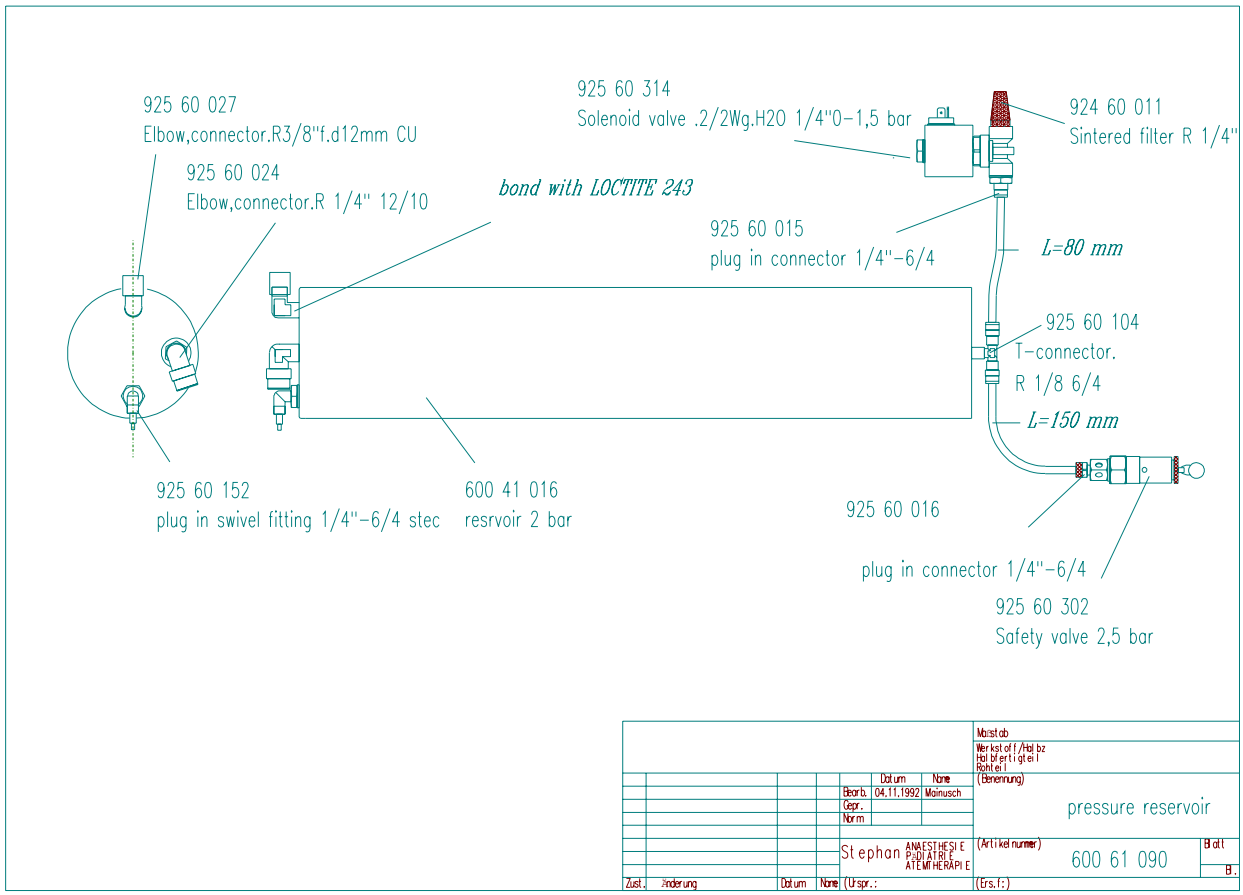
Spare parts

Microfilter (bacteria filter), article no: 701 60 250 **exchange after maximum 500 h**

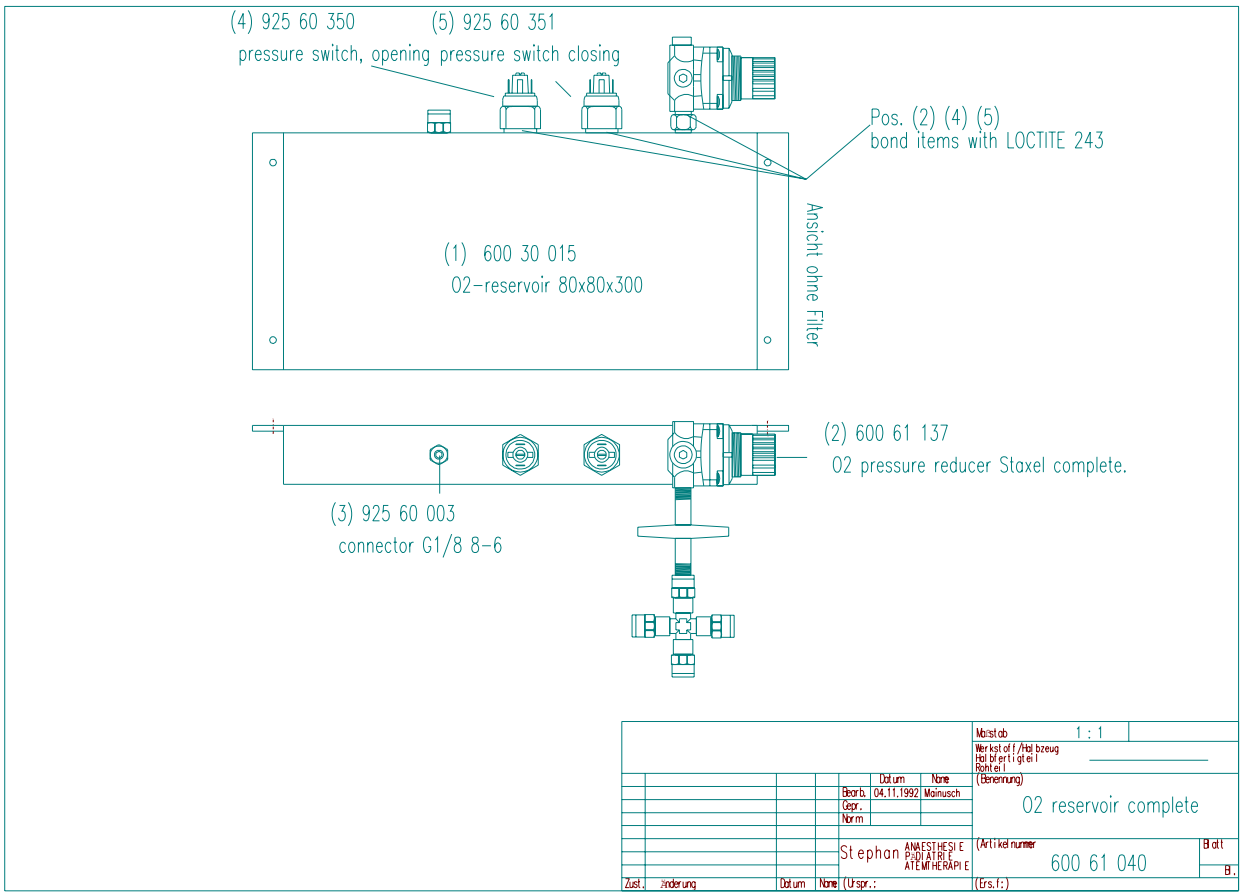
Intake filter mat article no: 701 60 205 **clean weekly, respectively exchange**

15. Modules with product numbers

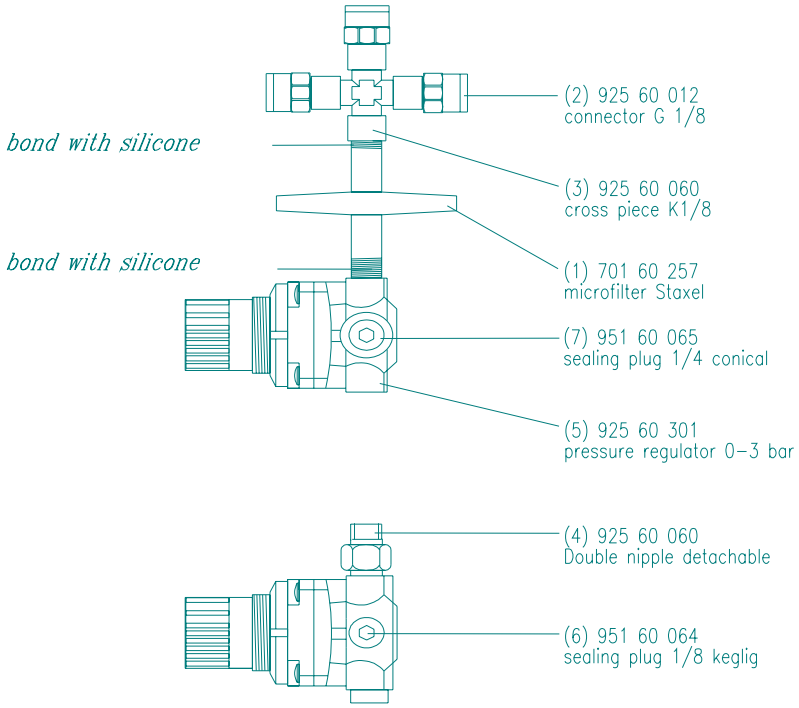
15.1 Pressure reservoir complete



15.1 O2 – reservoir, complete

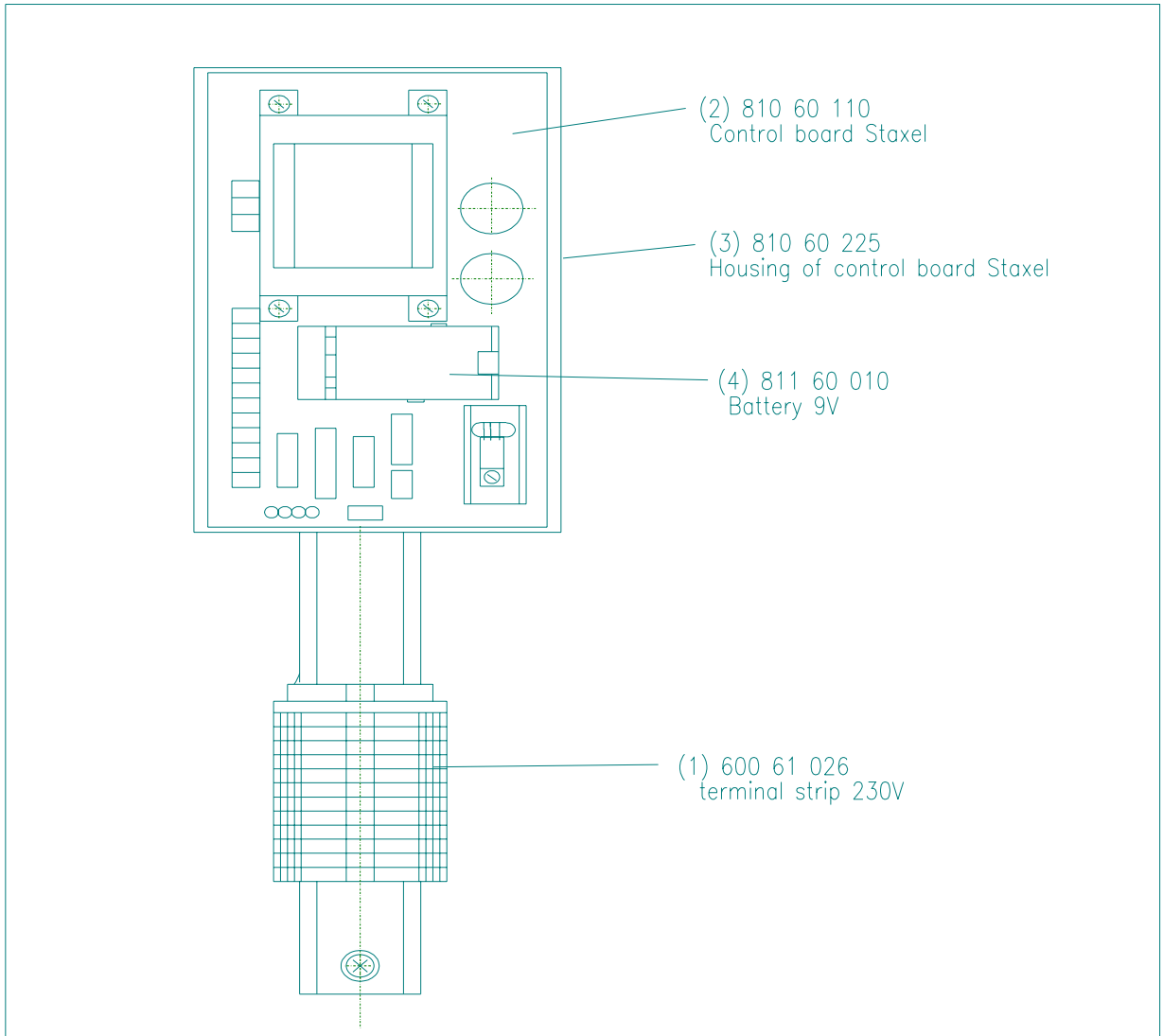


15.3. O2 pressure reducer STAXEL, complete



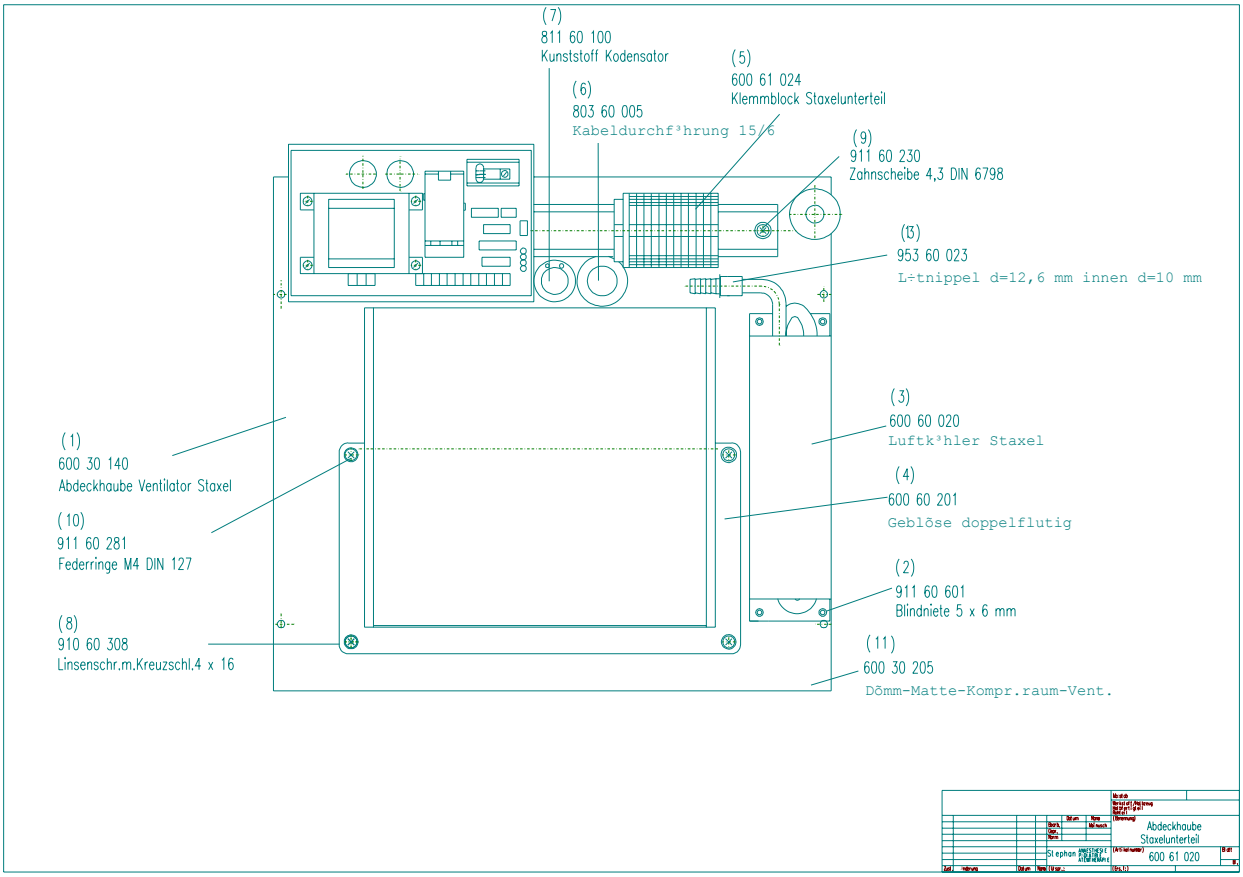
						Maßstab	
						Werkstoff/Halbzeug Halbfertigteil Rohteil	
					Datum	Name	(Benennung)
				Bearb.	04.11.1992	Mainusch	O2-pressure reducer Staxel complete
				Gepr.			
				Norm			
				Stephan ANAESTHESIE PÄDIATRIE ATEMTHERAPIE			(Artikelnummer) 600 61 137
Zust.	Änderung	Datum	Name	(Urspr.:			(Ers.f.:)

15.4 Terminal block STAXEL, bottom part

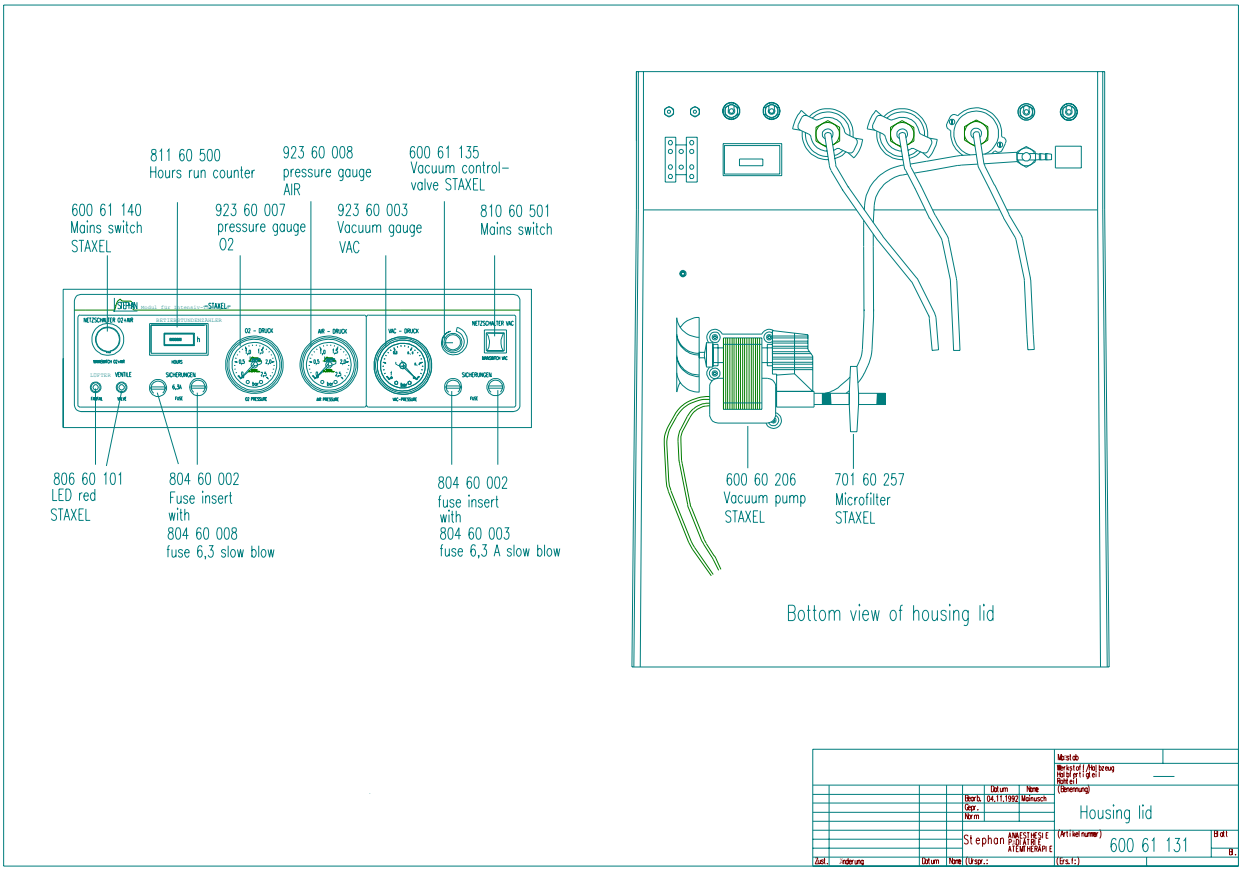


						Maßstab 1 : 1	
						Werkstoff/Halbzeug Halbfertigteil Rohteil	
					Datum	Name	(Benennung)
				Bearb.	04.11.1992	Mainusch	terminal block Staxel bottom part
				Gepr.			
				Norm			
				Stephan ANAESTHESIE PÄDIATRIE ATEMTHERAPIE			(Artikelnummer) 600 61 024
Zust.	Änderung	Datum	Name	(Urspr.:			(Ers.f.:)

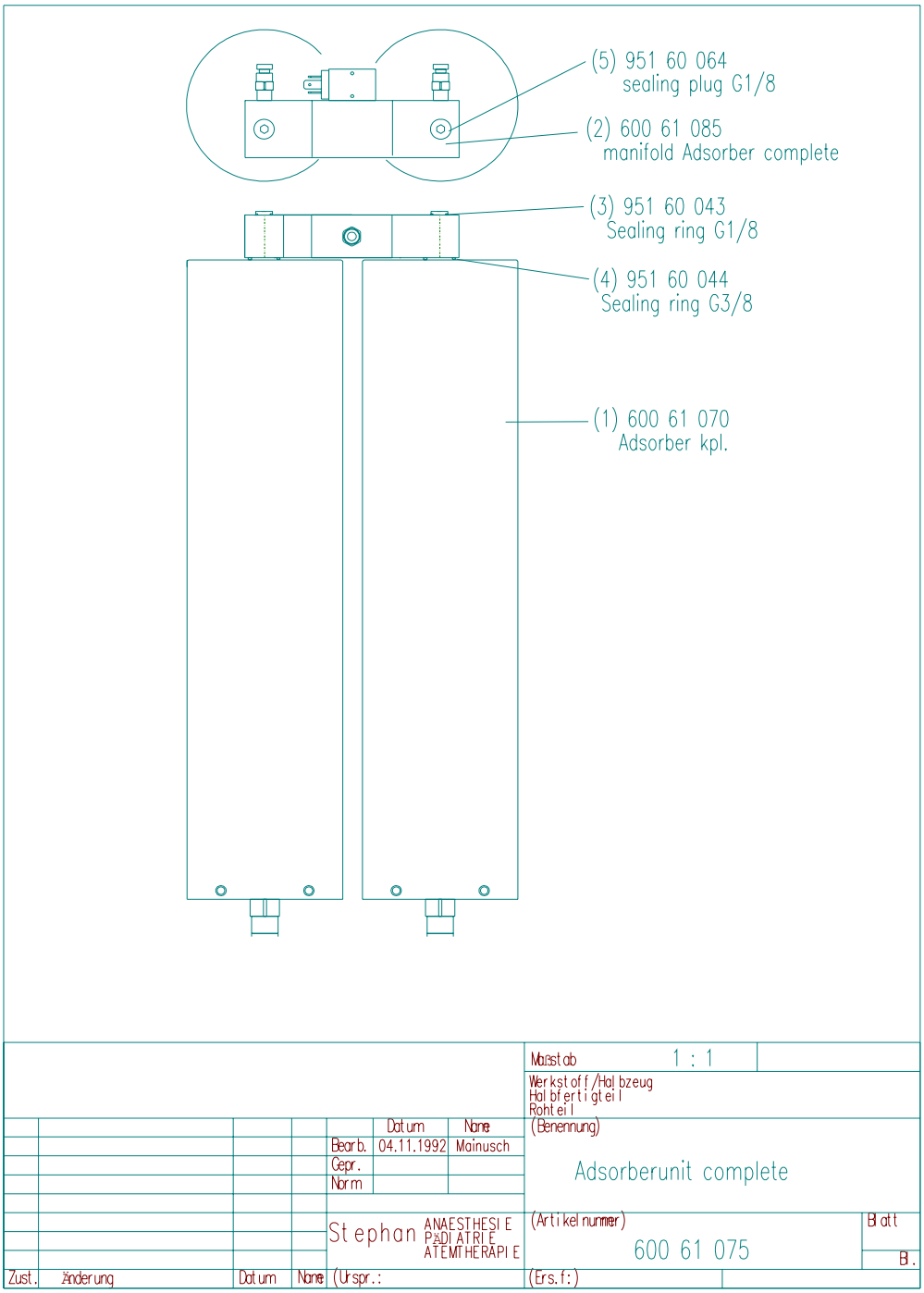
15.5 Cover STAXEL, bottom part



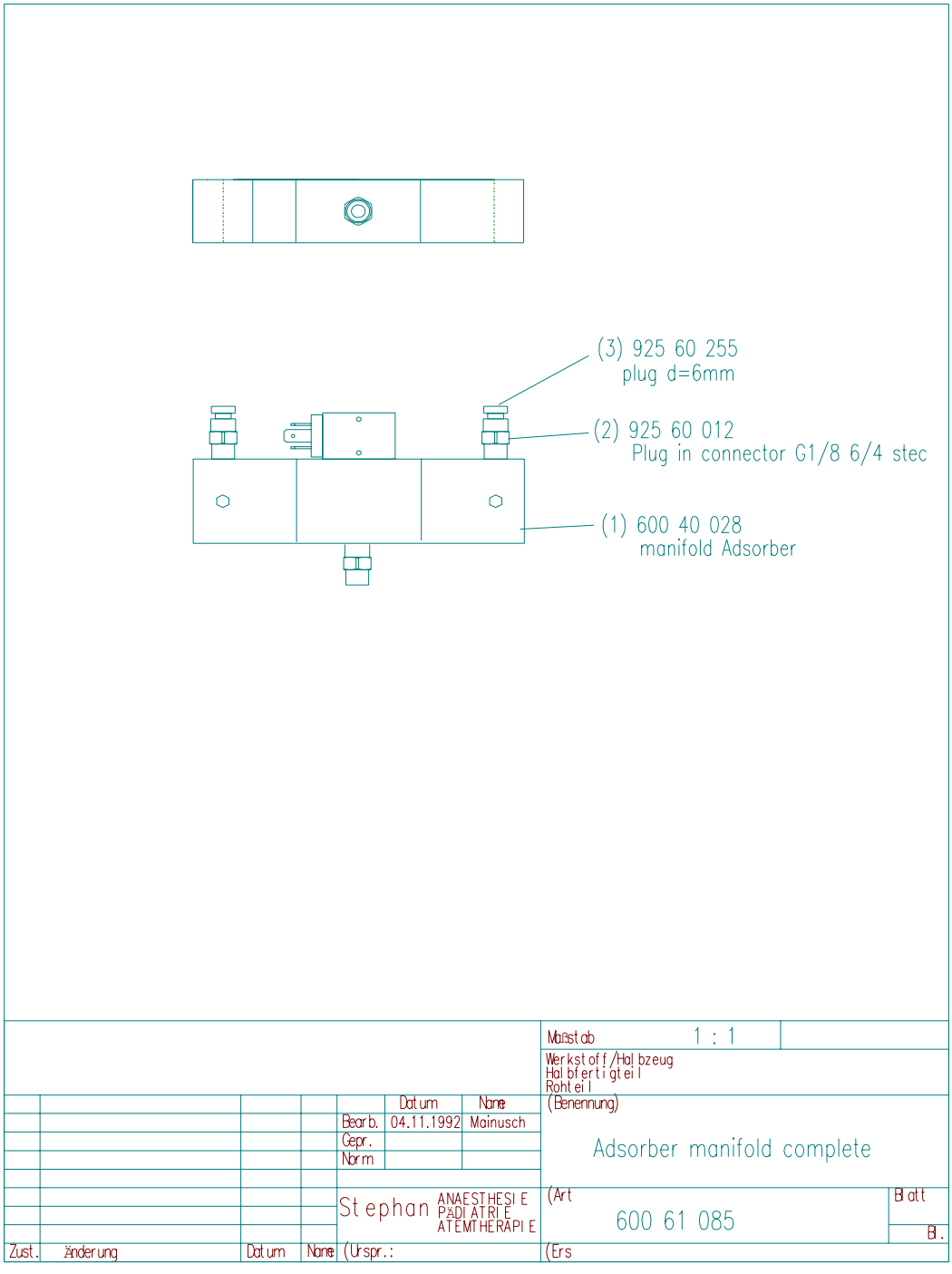
15.6 Housing lid STAXEL



15.7. Adsorber unit, complete



15.8. Adsorber manifold, complete



15.9 Compressor unit, pre-assembled